TREATMENT OF BRAIN CANCER

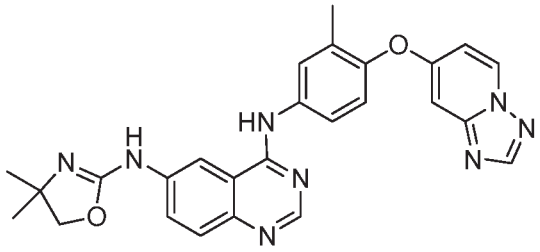
BACKGROUND OF THE INVENTION

[0001] FIELD OF THE INVENTION

[0002] *N*4-(4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine for the treatment of brain cancer is provided herein.

[0003] DESCRIPTION OF THE STATE OF THE ART

[0004] *N*4-(4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine (also called "ARRY-380"), which has the structure:



is a selective ErbB2 (HER2) inhibitor described in WO 2007/059257, which is incorporated by reference in its entirety. *N*4-(4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine has been tested in human clinical trials for hyperproliferative diseases, particularly cancer, and more particularly metastatic breast cancer, colorectal cancer, and salivary gland cancer (see Koch, Kevin. "ARRY-380: A Selective, Oral HER2 Inhibitor for the Treatment of Solid Tumors." American Association of Cancer Research 102nd Annual Meeting, April 3, 2011; which may also be found at: http://www.arraybiopharma.com/_documents/Publication/PubAttachment462.pdf).

[0005] Amplification or over-expression of ErbB2 has been shown to play a role in the pathogenesis and progression of certain cancers, such as breast, ovarian, gastric, uterine, colorectal and non-small cell lung cancer.

[0006] In breast cancer patients, brain metastases are a leading cause of death in ErbB2+ breast cancer patients and a serious unmet medical need. Patients with ErbB2+ breast cancer have a significantly increased incidence of brain metastases following trastuzumab therapy. There is an increasing incidence of brain metastases as women are living longer due to better treatments for systemic disease.

[0007] Accordingly, there remains a need for the treatment of brain cancer.

SUMMARY OF THE INVENTION

[0008] One aspect of the present invention provides *N*4-(4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol for use in treating brain cancer.

[0009] Another aspect provides a method of treating brain cancer in a mammal comprising administering a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol to the mammal.

[0010] Another aspect provides a method of treating brain cancer in a patient having brain cancer comprising administering a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol to the patient.

[0011] Another aspect provides a method of treating or preventing brain cancer in a mammal in need of such treatment, wherein the method comprises administering to said mammal a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol.

[0012] Another aspect provides a use of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol in the manufacture of a medicament for the treatment of brain cancer.

[0013] Another aspect provides a pharmaceutical composition for the treatment of brain cancer, comprising *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-

([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof.

BRIEF DESCRIPTION OF THE FIGURES

[0014] Figure 1 shows the results of the growth of NCI-N87 cells implanted intracranially in mice.

[0015] Figure 2 shows the results of xenograft growth study of NCI-N87 cells implanted intracranially in mice.

[0016] Figure 3 shows the results of xenograft growth study of NCI-N87 cells implanted intracranially in mice.

[0017] Figure 4 shows the plasma results of brain pharmacokinetic study in mice.

[0018] Figure 5 shows the brain results of brain pharmacokinetic study in mice.

[0019] Figure 6 shows the results of xenograft growth study of BT474 cells implanted intracranially in mice.

[0020] Figure 7 shows the results of xenograft growth study of NCI-N87 cells implanted subcutaneously in mice.

DETAILED DESCRIPTION OF THE INVENTION

[0021] Reference will now be made in detail to certain embodiments. While enumerated embodiments will be described, it will be understood that they are not intended to limit the invention to those embodiments. On the contrary, the invention is intended to cover all alternatives, modifications, and equivalents, which may be included within the scope of the present invention as defined by the claims. One skilled in the art will recognize many methods and materials similar or equivalent to those described herein, which could be used in the practice of the present invention. In the event that one or more of the incorporated literature and similar materials differs from or contradicts this application, including but not limited to defined terms, term usage, described techniques, or the like, this application controls.

[0022] DEFINITIONS

[0023] The term "about" is used herein to mean approximately, in the region of, roughly, or around. When the term "about" is used in conjunction with a numerical range, it modifies that range by extending the boundaries above and below the numerical values set forth. In general, the term "about" is used herein to modify a numerical value above and below the stated value by a variance of 20%.

[0024] The term "amorphous" means a solid in a solid state that is a non-crystalline state. Amorphous solids generally possess crystal-like short range molecular arrangement, but no long range order of molecular packing as found in crystalline solids. The solid state form of a solid may be determined by polarized light microscopy, x-ray powder diffraction, differential scanning calorimetry, or other standard techniques known to those of skill in the art.

[0025] The phrase "amorphous solid dispersion" means a solid comprising a drug substance and a dispersion polymer. The amorphous solid dispersion discussed herein comprises amorphous *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol as the drug substance component and a dispersion polymer, wherein the amorphous solid dispersion contains the drug substance component in a substantially amorphous solid state form. In certain embodiments, the substantially amorphous solid state form means at least 80% amorphous drug substance component. In certain embodiments, the substantially amorphous solid state form means at least 85% drug substance component. In certain embodiments, the substantially amorphous solid state form means at least 90% amorphous drug substance component. In certain embodiments, the substantially amorphous solid state form means at least 95% amorphous drug substance component.

[0026] The phrase "dispersion polymer" means a polymer that allows for *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol to be dispersed throughout such that a solid dispersion may form. The dispersion polymer is preferably neutral or basic. The dispersion polymer may contain a mixture of two or more polymers. Examples of dispersion polymers include, but are not limited to, vinyl polymers and copolymers, vinylpyrrolidine vinylacetate copolymer ("PVP-VA"), polyvinyl alcohols, polyvinyl alcohol polyvinyl acetate copolymers, polyvinyl pyrrolidine ("PVP"), acrylate and methacrylate copolymers, methylacrylic acid methyl methacrylate copolymer (such as Eudragit®), polyethylene polyvinyl alcohol copolymers, polyoxyethylene-polyoxypropylene block copolymers (also referred to as poloxamers), graft copolymer comprised of polyethylene glycol, polyvinyl caprolactam and polyvinyl acetate (such as

Soluplus®), cellulosic polymers, such as hydroxypropyl methyl cellulose acetate ("HPMCA"), hydroxypropyl methyl cellulose ("HPMC"), hydroxypropyl cellulose ("HPC"), methyl cellulose, hydroxyethyl methyl cellulose, hydroxyethyl cellulose, hydroxyethyl cellulose acetate, and hydroxyethyl ethyl cellulose, hydroxypropyl methyl cellulose acetate succinate ("HPMCAS"), hydroxypropyl methyl cellulose phthalate ("HPMCP"), carboxymethylethyl cellulose ("CMEC"), cellulose acetate phthalate ("CAP"), cellulose acetate succinate ("CAS"), hydroxypropyl methyl cellulose acetate phthalate ("HPMCAP"), cellulose acetate trimellitate ("CAT"), hydroxypropyl methyl cellulose acetate trimellitate ("HPMCAT"), and carboxymethylcellulose acetate butyrate ("CMCAB"), and the like.

[0027] The term "drug substance component" means the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol component of the solid dispersion.

[0028] The term "mammal" means a warm-blooded animal that has or is at risk of developing a disease described herein and includes, but is not limited to, guinea pigs, dogs, cats, rats, mice, hamsters, and primates, including humans.

[0029] The phrase "pharmaceutically acceptable" indicates that the substance or composition is compatible chemically and/or toxicologically, with the other ingredients comprising a formulation, and/or the mammal being treated therewith.

[0030] The phrase "solid dispersion" means a system in a solid state comprising at least two components, wherein one component is dispersed throughout the other component. The solid dispersion discussed herein comprises one component of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol, the drug substance component, dispersed throughout another component, particularly a dispersion polymer.

[0031] The phrase "spray drying" means processes involved in breaking up liquid mixtures into small droplets (atomization) and rapidly removing solvent from the mixture in a spray drying apparatus where there is a strong driving force for evaporation of solvent from the droplets. The phrase spray drying is used conventionally and broadly. Spray drying processes and spray drying equipment are described generally in Perry, Robert H., and Don

W. Green (eds.). Perry's Chemical Engineers' Handbook. New York: McGraw-Hill, 2007 (8th edition).

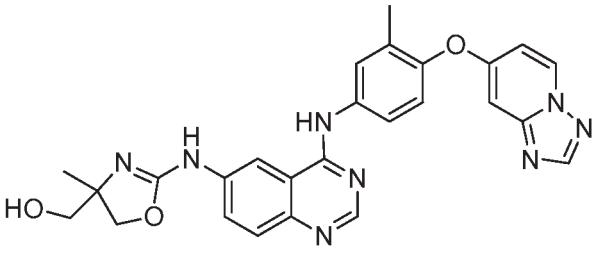
[0032] The phrases "therapeutically effective amount" or "effective amount" mean an amount of a compound described herein that, when administered to a mammal in need of such treatment, sufficient to (i) treat or prevent the particular disease, condition, or disorder, (ii) attenuate, ameliorate, or eliminate one or more symptoms of the particular disease, condition, or disorder, or (iii) prevent or delay the onset of one or more symptoms of the particular disease, condition, or disorder described herein. The amount of a compound that will correspond to such an amount will vary depending upon factors such as the particular compound, disease condition and its severity, the identity (*e.g.*, weight) of the mammal in need of treatment, but can nevertheless be routinely determined by one skilled in the art.

[0033] The terms "treat" or "treatment" refer to therapeutic, prophylactic, palliative or preventative measures. Beneficial or desired clinical results include, but are not limited to, alleviation of symptoms, diminishment of extent of disease, stabilized (*i.e.*, not worsening) state of disease, delay or slowing of disease progression, amelioration or palliation of the disease state, and remission (whether partial or total), whether detectable or undetectable. "Treatment" can also mean prolonging survival as compared to expected survival if not receiving treatment. Those in need of treatment include those already with the condition or disorder, as well as those prone to have the condition or disorder or those in which the condition or disorder is to be prevented.

[0034] TREATMENT OF BRAIN CANCER

[0035] Provided herein is *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine for use in treating brain cancer.

[0036] It has been found that (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol (also called "AR00440993"), which has the structure:



is an active metabolite of ARRY-380. (2-((4-((4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol has higher brain penetration than either ARRY-380 or lapatinib (see Example 1). This active metabolite helps maintain sustained levels of drug in the brain after oral dosing of ARRY-380, which may contribute to enhanced activity.

[0037] In certain embodiments, *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine for use in the treatment of brain cancer is provided.

[0038] In certain embodiments, (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol for use in the treatment of brain cancer is provided.

[0039] In certain embodiments, *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for use in the treatment of brain cancer are provided.

[0040] In certain embodiments, (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol for use in the treatment of brain cancer comprising administering *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine is provided.

[0041] Brain cancer includes anaplastic astrocytoma, anaplastic mixed glioma, anaplastic oligoastrocytoma, anaplastic oligodendroglioma, germinoma, glioblastoma multiforme, gliosarcoma, low grade astrocytoma, low grade mixed oligoastrocytoma, low grade oligodendroglioma, central nervous system lymphoma, medulloblastoma, meningioma, pilocytic astrocytoma, acoustic neuroma, chordoma, craniopharyngioma, brain stem glioma, ependymoma, optic nerve glioma, subependymoma, metastaic brain tumors, pituitary tumors, primitive neuroectodermal and scwannoma.

[0042] In certain embodiments, the brain cancer is local or metastatic brain cancer that is ErbB2 driven. In certain embodiments, the brain cancer is local or metastatic brain cancer that is driven by ErbB2. In certain embodiments, the brain cancer is local or metastatic brain cancer that is caused by ErbB2 over-expression and amplification. In certain embodiments, the brain cancer is local or metastatic brain cancer that is caused by ErbB2

over-expression or amplification. In certain embodiments, the brain cancer is local or metastatic brain cancer that is caused by ErbB2 over-expression. In certain embodiments, the brain cancer is local or metastatic brain cancer that is caused by ErbB2 amplification. In certain embodiments, the brain cancer is local or metastatic brain cancer that is ErbB2 positive.

[0043] Brain cancer includes gliomas, meningiomas, pituitary adenomas and nerve sheath tumors. Brain cancer also includes anaplastic astrocytoma, anaplastic mixed glioma, anaplastic oligoastrocytoma, anaplastic oligodendroglioma, germinoma, glioblastoma multiforme, gliosarcoma, low grade astrocytoma, low grade mixed oligoastrocytoma, low grade oligodendroglioma, central nervous system lymphoma, medulloblastoma, meningioma (particularly WHO Grade II and III), and pilocytic astrocytoma. Brain cancer also includes acoustic neuroma, pilocytic astrocytoma (WHO Grade I), low-grade astrocytoma (WHO Grade II), anaplastic astrocytoma (WHO Grade III), glioblastoma multiforme (WHO Grade IV), chordoma, central nervous system lymphoma, craniopharyngioma, brain stem glioma, ependymoma, mixed glioma, optic nerve glioma, subependymoma, medulloblastoma, meningioma, metastaic brain tumors, oligodendroglioma, pituitary tumors, primitive neuroectodermal, and scwannoma. In certain embodiments, the brain cancer is ErbB2 positive. In certain embodiments, the brain cancer is caused by ErbB2 over-expression or amplification.

[0044] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine for use in the treatment of brain cancer is administered from about 0.1 to about 2000 mg per day. The total dose need not be administered all at once. In certain embodiments, the administration is from about 25 to about 1600 mg per day. In certain embodiments, the administration is from about 100 to about 1600 mg per day. In certain embodiments, the administration is from about 800 to about 1600 mg per day. In certain embodiments, the administration is at 800 to 1600 mg per day. In certain embodiments, the administration is from about 800 to about 1300 mg per day. In certain embodiments, the administration is at 800 to 1300 mg per day. In certain embodiments, the administration is from about 1100 to about 1300 mg per day. In certain embodiments, the administration is at 1100 to 1300 mg per day. In certain embodiments, the administration is from about 1200 to about 1300 mg per day. In certain embodiments, the administration is at 1200 to 1300 mg per day. In certain embodiments, the

administration is from about 1200 mg per day. In certain embodiments, the administration is at 1200 mg per day.

[0045] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine for the treatment of brain cancer is administered from about 400 to about 800 mg twice per day. In certain embodiments, the administration is at 400 to 800 mg twice per day. In certain embodiments, the administration is from about 400 to about 650 mg twice per day. In certain embodiments, the administration is at 400 to 650 mg twice per day. In certain embodiments, the administration is from about 550 to about 650 mg twice per day. In certain embodiments, the administration is at 550 to 650 mg twice per day. In certain embodiments, the administration is from about 600 to about 650 mg twice per day. In certain embodiments, the administration is at 600 to 650 mg twice per day. In certain embodiments, the administration is at about 600 mg twice per day. In certain embodiments, the administration is at 600 mg twice per day.

[0046] In certain embodiments, the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol for the treatment of brain cancer is administered from about 0.1 to about 2000 mg per day. The total dose need not be administered all at once. In certain embodiments, the administration is from about 25 to about 1800 mg per day. In certain embodiments, the administration is from about 25 to about 1600 mg per day. In certain embodiments, the administration is from about 100 to about 1800 mg per day. In certain embodiments, the administration is from about 100 to about 1600 mg per day. In certain embodiments, the administration is from about 800 to about 1600 mg per day. In certain embodiments, the administration is at 800 to 1600 mg per day. In certain embodiments, the administration is from about 800 to about 1300 mg per day. In certain embodiments, the administration at 800 to 1300 mg per day. In certain embodiments, the administration is from about 1100 to about 1300 mg per day. In certain embodiments, the administration is at 1100 to 1300 mg per day. In certain embodiments, the administration is from about 1200 to about 1300 mg per day. In certain embodiments, the administration is at 1200 to 1300 mg per day. In certain embodiments, the administration is at about 1200 mg per day. In certain embodiments, the administration is at 1200 mg per day.

[0047] In certain embodiments, the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol

for the treatment of brain cancer is admininstered from about 100 to about 1000 mg twice per day. In certain embodiments, the administration is from about 100 to about 800 mg twice per day. In certain embodiments, the administration is from about 100 to about 750 mg twice per day. In certain embodiments, the administration is from about 100 to about 600 mg twice per day. In certain embodiments, the administration is from about 200 to about 800 mg twice per day. In certain embodiments, the administration is from about 400 to about 800 mg twice per day. In certain embodiments, the administration is at 400 to 800 mg twice per day. In certain embodiments, the administration is from about 400 to about 650 mg twice per day. In certain embodiments, the administration is at 400 to 650 mg twice per day. In certain embodiments, the administration is from about 550 to about 650 mg twice per day. In certain embodiments, the administration is at 550 to 650 mg twice per day. In certain embodiments, the administration is from about 600 to about 650 mg twice per day. In certain embodiments, the administration is at 600 to 650 mg twice per day. In certain embodiments, the administration is at about 600 mg twice per day. In certain embodiments, the administration is at 600 mg twice per day.

[0048] In certain embodiments, the mixture of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol for the treatment of brain cancer is administered from about 0.1 to about 2000 mg per day. The total dose need not be administered all at once. In certain embodiments, the administration is from about 25 to about 1800 mg per day. In certain embodiments, the administration is from about 25 to about 1600 mg per day. In certain embodiments, the administration is from about 100 to about 1800 mg per day. In certain embodiments, the administration is from about 100 to about 1600 mg per day. In certain embodiments, the administration is from about 800 to about 1600 mg per day. In certain embodiments, the administration is at 800 to 1600 mg per day. In certain embodiments, the administration is from about 800 to about 1300 mg per day. In certain embodiments, the administration is at 800 to 1300 mg per day. In certain embodiments, the administration is from about 1100 to about 1300 mg per day. In certain embodiments, the administration is at 1100 to 1300 mg per day. In certain embodiments, the administration is from about 1200 to about 1300 mg per day. In certain embodiments, the administration is at 1200 to 1300 mg per day. In certain embodiments, the administration is at about 1200 mg per day. In certain embodiments, the administration is at 1200 mg per day.

[0049] In certain embodiments, the mixture of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol for the treatment of brain cancer is administered from about 100 to about 1000 mg twice per day. In certain embodiments, the administration is from about 100 to about 800 mg twice per day. In certain embodiments, the administration is from about 100 to about 750 mg twice per day. In certain embodiments, the administration is from about 100 to about 600 mg twice per day. In certain embodiments, the administration is from about 200 to about 800 mg twice per day. In certain embodiments, the administration is from about 400 to about 800 mg twice per day. In certain embodiments, the administration is at 400 to 800 mg twice per day. In certain embodiments, the administration is from about 400 to about 650 mg twice per day. In certain embodiments, the administration is at 400 to 650 mg twice per day. In certain embodiments, the administration is from about 550 to about 650 mg twice per day. In certain embodiments, the administration is at 550 to 650 mg twice per day. In certain embodiments, the administration is from about 600 to about 650 mg twice per day. In certain embodiments, the administration is at 600 to 650 mg twice per day. In certain embodiments, the administration is at about 600 mg twice per day. In certain embodiments, the administration is at 600 mg twice per day.

[0050] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for the treatment of brain cancer is administered as an oral dosage form.

[0051] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for the treatment of brain cancer is provided in a solid dispersion dosage form. In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for the treatment of brain cancer is provided in a solid dispersion oral dosage form.

[0052] Solid dispersions are generally prepared by dissolving the drug substance and the dispersion polymer in a suitable solvent to form a feed solution, and then the feed solution may be spray dried to form the solid dispersion (and remove the solvent). Spray drying is a known process. Spray drying is generally performed by dissolving the drug substance component and the dispersion polymer in a suitable solvent to prepare a feed solution. The feed solution may be pumped through an atomizer into a drying chamber. The feed solution can be atomized by conventional means known in the art, such as a two-fluid sonicating nozzle, a pressure nozzle, a rotating nozzle and a two-fluid non-sonicating nozzle. Then, the solvent is removed in the drying chamber to form the solid dispersion. A typical drying chamber uses hot gases, such as forced air, nitrogen, nitrogen-enriched air, or argon to dry particles. The size of the drying chamber may be adjusted to achieve particle properties or throughput.

[0053] Although the solid dispersion are preferably prepared by conventional spray drying techniques, other techniques known in the art may be used, such as melt extrusion, freeze drying, rotary evaporation, drum drying or other solvent removal processes.

[0054] In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP, CAP, HPMCAS and HPMC and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP, CAP, HPMCAS and HPMC. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55, CAP, HPMCAS Grade M, HPMC and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55, CAP, HPMCAS Grade M and HPMC.

[0055] In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP, CAP and HPMCAS, and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP, CAP and HPMCAS. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55, CAP and HPMCAS Grade M, and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55, CAP and HPMCAS Grade M.

[0056] In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP, CAP and HPMC, and mixtures

thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP, CAP and HPMC. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55, CAP and HPMC, and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55, CAP and HPMC.

[0057] In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP and CAP, and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, methylacrylic acid methyl methacrylate copolymer, HPMCP and CAP. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55 and CAP, and mixtures thereof. In certain embodiments, the dispersion polymer is selected from PVP-VA, Eudragit® L100, HPMCP H-55 and CAP.

[0058] In certain embodiments, the dispersion polymer is PVP-VA.

[0059] In certain embodiments, the dispersion polymer is methylacrylic acid methyl methacrylate copolymer. In certain embodiments, the dispersion polymer is Eudragit®. In certain embodiments, the dispersion polymer is Eudragit® L100.

[0060] In certain embodiments, the dispersion polymer is HPMCP. In certain embodiments, the dispersion polymer is HPMCP H-55.

[0061] In certain embodiments, the dispersion polymer is CAP.

[0062] In certain embodiments, the dispersion polymer is HPMCAS. In certain embodiments, the dispersion polymer is HPMCAS Grade M.

[0063] In certain embodiments, the dispersion polymer is preferably neutral or basic. In certain embodiments, the dispersion polymer is selected from PVP-VA and HPMC. In certain embodiments, the dispersion polymer is HPMC.

[0064] Suitable solvents are a solvent or mixture of solvents in which both drug substance component and the dispersion polymer have adequate solubility (solubility greater than 1 mg/mL). A mixture of solvents may be used if each component of the solid dispersion (*i.e.*, drug substance component and dispersion polymer) requires different solvents to obtain the desired solubility. The solvent may be volatile with a boiling point of 150°C or less. In addition, the solvent should have relatively low toxicity and be removed from the dispersion to a level that is acceptable to The International Committee on Harmonization ("ICH") guidelines. Removal of solvent to this level may require a subsequent processing step, such as tray drying. Examples of suitable solvents include, but are not limited to, alcohols, such as

methanol ("MeOH"), ethanol ("EtOH"), n-propanol, isopropanol ("IPA") and butanol; ketones, such as acetone, methyl ethyl ketone ("MEK") and methyl isobutyl ketone; esters, such as ethyl acetate ("EA") and propyl acetate; and various other solvents, such as tetrahydrofuran ("THF"), acetonitrile ("ACN"), methylene chloride, toluene and 1,1,1-trichloroethane. Lower volatility solvents, such as dimethyl acetate or dimethylsulfoxide ("DMSO"), may be used. Mixtures of solvents with water may also be used, so long as the dispersion polymer and the drug substance are sufficiently soluble to make the spray drying process practicable. Generally, due to the hydrophobic nature of low solubility drugs, non-aqueous solvents may be used, meaning the solvent comprises less than about 10 weight % water.

[0065] In certain embodiments, the suitable solvent is selected from MeOH and THF, and mixtures thereof. In certain embodiments, the suitable solvent is MeOH:THF solvent system of about 1:3. In certain embodiments, the suitable solvent is a 1:3 MeOH:THF solvent system.

[0066] In certain embodiments, the suitable solvent is selected from MeOH, THF and water, and mixtures thereof. In certain embodiments, the suitable solvent is selected from MeOH, THF and water. In certain embodiments, the suitable solvent is a THF:MeOH:water solvent system of about 80:10:10. In certain embodiments, the suitable solvent is a 80:10:10 THF:MeOH:water solvent system. In certain embodiments, the suitable solvent is a THF:MeOH:water solvent system of about 82:8:10. In certain embodiments, the suitable solvent is a 82:8:10 THF:MeOH:water solvent system. In certain embodiments, the suitable solvent is a THF:MeOH:water solvent system of about 82.2:8.2:9.6. In certain embodiments, the suitable solvent is a 82.2:8.2:9.6 THF:MeOH:water solvent system.

[0067] In certain embodiments, the amount of drug substance component in the solid dispersion ranges from about 0.1% to about 70% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion ranges from 0.1% to 70% by weight relative to the dispersion polymer.

[0068] In certain embodiments, the amount of drug substance component in the solid dispersion ranges from about 1% to about 60% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion ranges from 1% to 60% by weight relative to the dispersion polymer.

[0069] In certain embodiments, the amount of drug substance component in the solid dispersion ranges from about 5% to about 60% by weight relative to the dispersion polymer.

In certain embodiments, the amount of drug substance component in the solid dispersion ranges from 5% to 60% by weight relative to the dispersion polymer.

[0070] In certain embodiments, the amount of drug substance component in the solid dispersion ranges from about 55% to about 65% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion ranges from 55% to 65% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion is about 60% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion is 60% by weight relative to the dispersion polymer.

[0071] In certain embodiments, the amount of drug substance component in the solid dispersion ranges from about 25% to about 35% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion ranges from 25% to 35% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion is about 30% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion is 30% by weight relative to the dispersion polymer.

[0072] In certain embodiments, the amount of drug substance component in the solid dispersion ranges from about 45% to about 55% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion ranges from 45% to 55% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion is about 50% by weight relative to the dispersion polymer. In certain embodiments, the amount of drug substance component in the solid dispersion is 50% by weight relative to the dispersion polymer.

[0073] In certain embodiments, the solid dispersion is an amorphous solid dispersion. In certain embodiments, the solid dispersion is administered orally. In certain embodiments, the solid dispersion is in a tablet. In certain embodiments, the amorphous solid dispersion is in a tablet.

[0074] In certain embodiments, the administration of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-

methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof is administered orally. In certain embodiments, the administration of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof is administered in the form of a tablet.

[0075] In certain embodiments, the treatment of brain cancer with *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof is in combination with another therapeutic agent. Such therapeutic agents are suitably present in combination in amounts that are effective for the purpose intended. The compounds may be administered together in a unitary pharmaceutical composition or separately and, when administered separately this may occur simultaneously or sequentially in any order. Such sequential administration may be close in time or remote in time.

[0076] In certain embodiments, the therapeutic agent is selected from trastuzumab, capecitabine, bevacizumab, and taxanes. In certain embodiments, the therapeutic agent is selected from trastuzumab, capecitabine, bevacizumab, paclitaxel and docetaxel. In certain embodiments, the therapeutic agent is trastuzumab. In certain embodiments, the therapeutic agent is capecitabine. In certain embodiments, the therapeutic agent is bevacizumab. In certain embodiments, the therapeutic agent is paclitaxel. In certain embodiments, the therapeutic agent is docetaxel.

[0077] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for use in treating brain cancer, is used after previous treatment for cancer.

[0078] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for use in treating brain cancer, is used after previous treatment for brain cancer. In certain embodiments, the previous

treatment for brain cancer is selected from surgery, radiation therapy and chemotherapy or mixtures thereof. In certain embodiments, the previous treatment for brain cancer is selected from surgery, conventional external radiation therapy, three-dimensional conformal radiation therapy, intensity modulated radiation therapy, stereotactic radiosurgery, fractionated stereotactic radiation therapy, proton radiation therapy, internal or implant radiation therapy, temozolomide, bevacizumab, carmustine, lomustine, procarbazine, vincristine, tumor treating fields therapy, everolimus, procarbazine, lomustine, cisplatin, carboplatin and methotrexate or mixtures thereof.

[0079] In certain embodiments, the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof for use in treating brain cancer, is used after previous treatment for breast cancer. In certain embodiments, the previous treatment for breast cancer is selected from surgery, sentinel lymph node biopsy followed by surgery, radiation therapy, chemotherapy, hormone therapy and targeted therapy. In certain embodiments, the previous treatment for breast cancer is selected from lumpectomy, partial mastectomy, segmental mastectomy, total mastectomy, modified radical mastectomy, external radiation, internal radiation, ado-trastuzumab emtansine, anastrozole, bevacizumab, capecitabine, carboplatin, cyclophosphamide, darbepoetin alfa, daunorubicin, denosumab, docetaxel, doxorubicin, epirubicin, epoetin alfa, eribulin, everolimus, exemestane, filgrastim, fluorouracil, fluoxymesterone, fulvestrant, gemcitabine, goserelin, ixabepilone, lapatinib, letrozole, leucovorin, leuprolide, megestrol, methotrexate, mitoxantrone, mutamycin, paclitaxel, paclitaxel albumin-stabilized nanoparticle formulation, pamidronate, pegfilgrastim, pertuzumab, raloxifene, tamoxifen, thiotepa, toremifene, trastuzumab, trastuzumab emtansine, triptorelin, vincristine, vinorelbine and zoledronic acid or mixtures thereof. In certain embodiments, the previous treatment for breast cancer is selected from bevacizumab, capecitabine, carboplatin, cyclophosphamide, daunorubicin, docetaxel, doxorubicin, epirubicin, eribulin, everolimus, fluorouracil, gemcitabine, ixabepilone, methotrexate, mitoxantrone, mutamycin, paclitaxel, paclitaxel albumin-stabilized nanoparticle formulation, tamoxifen, trastuzumab, trastuzumab emtansine, vincristine and vinorelbine or mixtures thereof.

[0080] In another embodiment, a method of treating brain cancer in a mammal comprising administering a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-

a]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol to the mammal is provided.

[0081] In another embodiment, a method of treating brain cancer in a patient having brain cancer comprising administering a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol to the patient is provided.

[0082] In another embodiment, a method of treating or preventing brain cancer in a mammal in need of such treatment, wherein the method comprises administering to said mammal a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol.

[0083] In another embodiment, a method of treating brain cancer in a mammal using (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol comprising administering an effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine to the mammal is provided.

[0084] In another embodiment, a method of treating brain cancer using (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol in a patient having brain cancer comprising administering an effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine to the patient is provided.

[0085] In another embodiment, a method of treating or preventing local or metastatic brain cancer that is caused by ErbB2 over-expression or amplification using (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol in a mammal in need of such treatment, wherein the method comprises administering to the mammal an effective amount of *N*4-(4-

([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine is provided.

[0086] In certain embodiments, the effective amount is a therapeutically effective amount.

[0087] Another embodiment provides the use of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol in the manufacture of a medicament for the treatment of brain cancer.

[0088] Suitable carriers and excipients are well known to those skilled in the art and are described in detail in, *e.g.*, Ansel, Howard C., et al., Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. Philadelphia: Lippincott, Williams & Wilkins, 2004; Gennaro, Alfonso R., et al. Remington: The Science and Practice of Pharmacy. Philadelphia: Lippincott, Williams & Wilkins, 2000; and Rowe, Raymond C. Handbook of Pharmaceutical Excipients. Chicago, Pharmaceutical Press, 2005.

[0089] The pharmaceutical compositions may also include one or more additional components, such as buffers, dispersion agents, surfactants, wetting agents, lubricating agents, emulsifiers, suspending agents, preservatives, antioxidants, opaquing agents, glidants, processing aids, colorants, sweeteners, perfuming agents, flavoring agents, diluents and other known additives to provide an elegant presentation of the drug, *i.e.*, a compound described herein or pharmaceutical composition thereof, or aid in the manufacturing of the pharmaceutical product, *i.e.*, medicament (see Ansel; Gennaro; and Rowe above). The components of the pharmaceutical composition should be pharmaceutically acceptable.

[0090] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 1 to about 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 0.1 to about 20 weight % of a disintegrant;

(c) about 0.1 to about 25 weight % of an osmogen;

(d) about 0.1 to about 10 weight % of a glidant;

(e) about 0.1 to about 10 weight % of a lubricant; and

(f) about 0.1 to about 25 weight % of a binder / diluent.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 1 to 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 0.1 to 20 weight % of a disintegrant;

(c) 0.1 to 25 weight % of an osmogen;

(d) 0.1 to 10 weight % of a glidant;

(e) 0.1 to 10 weight % of a lubricant; and

(f) 0.1 to 25 weight % of a binder / diluent.

[0091] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 25 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 5 to about 15 weight % of a disintegrant;

(c) about 15 to about 25 weight % of an osmogen;

(d) about 0.1 to about 3 weight % of a glidant;

(e) about 0.1 to about 3 weight % of a lubricant; and

(f) about 10 to about 25 weight % of a binder / diluent.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 25 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 5 to 15 weight % of a disintegrant;

(c) 15 to 25 weight % of an osmogen;

(d) 0.1 to 3 weight % of a glidant;

(e) 0.1 to 3 weight % of a lubricant; and

(f) 10 to 25 weight % of a binder / diluent.

[0092] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 40 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 5 to about 15 weight % of a disintegrant;

(c) about 15 to about 25 weight % of an osmogen;

(d) about 0.1 to about 3 weight % of a glidant;

(e) about 0.1 to about 3 weight % of a lubricant; and

(f) about 10 to about 25 weight % of a binder / diluent.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 40 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 5 to 15 weight % of a disintegrant;

(c) 15 to 25 weight % of an osmogen;

(d) 0.1 to 3 weight % of a glidant;

(e) 0.1 to 3 weight % of a lubricant; and

(f) 10 to 25 weight % of a binder / diluent.

[0093] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 1 to about 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-

yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 0.1 to about 20 weight % of a disintegrant;

(c) about 0.1 to about 25 weight % of an osmogen;

(d) about 0.1 to about 10 weight % of a glidant;

(e) about 0.1 to about 10 weight % of a lubricant; and

(f) about 0.1 to about 25 weight % of a filler.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 1 to 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 0.1 to 20 weight % of a disintegrant;

(c) 0.1 to 25 weight % of an osmogen;

(d) 0.1 to 10 weight % of a glidant;

(e) 0.1 to 10 weight % of a lubricant; and

(f) 0.1 to 25 weight % of a filler.

[0094] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 25 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 1 to about 10 weight % of a disintegrant;

(c) about 15 to about 25 weight % of an osmogen;

(d) about 0.1 to about 3 weight % of a glidant;

(e) about 0.1 to about 3 weight % of a lubricant; and

(f) about 10 to about 25 weight % of a filler.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 25 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 1 to 10 weight % of a disintegrant;

(c) 15 to 25 weight % of an osmogen;

(d) 0.1 to 3 weight % of a glidant;

(e) 0.1 to 3 weight % of a lubricant; and

(f) 10 to 25 weight % of a filler.

[0095] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 40 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 1 to about 10 weight % of a disintegrant;

(c) about 15 to about 25 weight % of an osmogen;

(d) about 0.1 to about 3 weight % of a glidant;

(e) about 0.1 to about 3 weight % of a lubricant; and

(f) about 10 to about 25 weight % of a filler.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 40 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 1 to 10 weight % of a disintegrant;

(c) 15 to 25 weight % of an osmogen;

(d) 0.1 to 3 weight % of a glidant;

(e) 0.1 to 3 weight % of a lubricant; and

(f) 10 to 25 weight % of a filler.

[0096] In certain embodiments, the pharmaceutical composition for the treatment of brain cancer comprises a solid disepersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine.

[0097] In certain embodiments, the pharmaceutical composition for the treatment of brain cancer comprises a solid disepersion of (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol.

[0098] In certain embodiments, the osmogen is selected from NaCl and KCl, and mixtures thereof.

[0099] In certain embodiments, the lubricant is magnesium stearate.

[00100] In certain embodiments, the glidant is colloidal silicon dioxide.

[00101] In certain embodiments, the binder / diluent is microcrystalline cellulose. In certain embodiments, the binder / diluent acts as both a binder and a diluent.

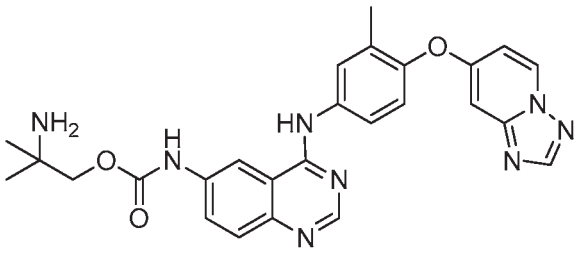
[00102] In certain embodiments, the binder is microcrystalline cellulose.

[00103] In certain embodiments, the diluent is microcrystalline cellulose.

[00104] In certain embodiments, the filler is lactose.

[00105] In certain embodiments, the disintegrant is selected from crospovidone and sodium bicarbonate ($NaHCO_3$), and mixtures thereof. In certain embodiments, the disintegrant is selected from crospovidone and sodium bicarbonate. In certain embodiments, the disintegrant is sodium bicarbonate. In certain embodiments, the disintegrant is crospovidone.

[00106] In certain embodiments, the composition contains sodium bicarbonate. *N*4-(4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine may slowly degrade, through hydrolysis or other means, to a carbamate impurity:



Sodium bicarbonate helps to slow the degradation to the carbamate impurity. Sodium bicarbonate also helps to provide consistent tablet disintegration when the tablets are exposed to different humidities.

[00107] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) sodium bicarbonate.

[00108] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 1 to about 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) about 0.1 to about 30 weight % sodium bicarbonate.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 1 to 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) 0.1 to 30 weight % sodium bicarbonate.

[00109] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 1 to about 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 0.1 to about 30 weight % sodium bicarbonate; and

(c) the remaining weight is other pharmaceutically acceptable excipients and carriers.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 1 to 70 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 0.1 to 30 weight % sodium bicarbonate; and

(c) the remaining weight is other pharmaceutically acceptable excipients and carriers.

[00110] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 25 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) about 1 to about 15 weight % of sodium bicarbonate.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 25 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) 1 to 15 weight % of sodium bicarbonate.

[00111] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 25 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-

dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 1 to about 15 weight % of sodium bicarbonate; and

(c) the remaining weight is other pharmaceutically acceptable excipients and carriers.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 25 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 1 to 15 weight % of sodium bicarbonate; and

(c) the remaining weight is other pharmaceutically acceptable excipients and carriers.

[00112] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 40 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) about 1 to about 15 weight % of sodium bicarbonate.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 40 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof; and

(b) 1 to 15 weight % of sodium bicarbonate.

[00113] Certain embodiments provide a pharmaceutical composition for the treatment of brain cancer comprising:

(a) about 40 to about 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) about 1 to about 15 weight % of sodium bicarbonate;

(c) the remaining weight is other pharmaceutically acceptable excipients and carriers.

In a further embodiment, the pharmaceutical composition for the treatment of brain cancer comprises:

(a) 40 to 60 weight % of a solid dispersion of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof;

(b) 1 to 15 weight % of sodium bicarbonate;

(c) the remaining weight is other pharmaceutically acceptable excipients and carriers.

[00114] The pharmaceutical composition preferably contains a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof. However, in some embodiments, each individual dose contains a portion of a therapeutically effective amount of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine or (2-((4-((4-([1,2,4]triazolo[1,5-a]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol or mixtures thereof, such that multiple doses of the composition may be required (for example, two or more tablets are required for a therapeutically effective amount). Thus, in this application when it states that the pharmaceutical composition contains a

therapeutically effective amount it means that the composition may be one dose (for example, one tablet) or multiple doses (for example, two tablets).

EXAMPLES

[00115] In the Examples described below, unless otherwise indicated all temperatures are set forth in degrees Celsius.

Example 1

Growth of NCI-N87 Gastric Carcinoma in Nude Mice Implanted Intracranially

[00116] Tumor cells (NCI-N87 gastric carcinoma cells, NCI, Bethesda, MD) were implanted in nude BALB/c female mice (Charles River Laboratories International, Inc.) via intracranial injection directly into the brain. The mice were separated into four groups (N = 5) and were injected with vehicle (saline), 1 X 10^5 tumor cells, 2.5 X 10^5 tumor cells, or 5 X 10^5 tumor cells. The results are shown in Figure 1. Brain tumor cell burden was associated with decreased survival in the NCI-N87 model.

[00117] In a pilot study using ^{14}C albumin as the tracer and mannitol as the positive control for blood brain barrier (BBB) disruption, it was confirmed that the intracranial inoculation procedure did not mechanically disrupt the blood brain barrier.

Example 2

Inhibition of NCI-N87 Gastric Carcinoma Xenograft Growth in Mice Implanted Intracranially

[00118] Anesthetized nude BALB/c female mice (Taconic Laboritories Inc., Germantown, NY) were inoculated with human tumor cells (NCI-N87 gastric carcinoma cells, NCI, Bethesda, MD) intracranially at lamba suture. 5 X 10^5 cells in saline were implanted via intracranial injection. The mice were separated into three groups (N = 12); vehicle (acidified 30 % Captisol®, pH about 4.5), 50 mg/kg lapatanib PO BID (30 % Captisol®), and 75 mg/kg *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine PO BID (acidified 30 % Captisol®, pH about 4.5). Dosing began two days after implantation. The dose may have been reduced as necessary if drug-related weight loss (approximately 5 %) was observed. The mice were monitored twice daily for general health and behavioral/neurological effects, and body weights (BW) were determined twice weekly. At first sign of neurological problem or body weight loss of greater than 20 %, the mice were euthanized by CO_2 inhalation. Brain and plasma were collected for analyses. Figure 2 shows the percentage of surviving mice. Figure 3 shows that *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-

dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine significantly decreases phospho-ErbB2 / total ErbB2 in the brain.

Example 3

Brain Pharmacokinetic (PK) Study in Mice

[00119] Nude female BALB/c mice were administered a single PO dose (dose volume 10 mL/kg) of lapatanib (50 mg/kg, 30 % Captisol®) and *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine (75 mg/kg, 30 % Captisol, weigh out compound and add 30 % Captisol® to give 7.5 mg/mL solution, then add 5 N HCl in 200 µL increments until it forms a clear, yellow solution). The mice were separated into groups and their PK was studied at 4 time points (0.5, 1, 2 and 4 hours, 4 mice per group per timepoint). The animals were euthanized by CO_2 inhalation at the time points. Whole blood was drawn (300 µL) by cardiac puncture and plced in an eppendorf tube containing ethylenediaminetetraacetic acid ("EDTA") (37.5 µL, 1.5%). The samples were centrifuged, and the plasma was decanted and frozen at -20 °C until delivered to analytical chemistry. The brains were collected. The animals were perfused with 5-10 mL of saline, and the brains were removed, weighed and placed into a fast prep tube for DMPK analysis.

[00120] The brain penetration of (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol was significantly higher than lapatanib or *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine. The plasma concertration (µg/mL) of the compounds is shown in Figure 4 and Table 1. The brain concentration (ng/g) of the compounds is shown in Figure 5 and Table 2. The brain:plasma ratio results are shown in Table 3.

Table 1

	Average Plasma Concentration (µg/mL)		
Time Point (hour)	Lapatanib	ARRY-380	AR00440993
0.5	1913.75	3350.00	20.20
1	4310.00	6417.50	67.33
2	1743.75	6012.50	134.40
4	1942.50	2640.00	70.43

Table 2

	Average Brain Concentration (ng/g)		
Time Point (hour)	Lapatanib	ARRY-380	AR00440993
0.5	44.92	122.38	BLQ
1	90.77	116.44	28.95
2	57.36	134.15	35.84
4	65.43	42.14	39.96

Table 3

Time Point (hour)	Lapatanib	ARRY-380	AR00440993
0.5	0.026	0.048	-
1	0.022	0.048	2.083
2	0.039	0.021	0.480
4	0.038	0.019	1.311

Example 4

Inhibition of BT474 Breast Carcinoma Xenograft Growth in Mice Implanted Intracranially

[00121] Nude NCr female mice (Taconic Laboritories Inc., Germantown, NY) were split into four groups (N = 13). 17β-estradiol (0.5 mg)/progesterone (10 mg) pellets (35-day release) were implanted 1 day prior to BT-474 tumor cell inoculation. Tumor cells (1 X 10^6 BT474 breast carcinoma cells, ATCC, Manassas, VA) were implanted into the mice via intracranial injection directly into the brain. Treatment with vehicle or drugs began 2 days post-tumor cell implantation. The mice were administered vehicle (acidified 30 % Captisol®, pH about 4.5, 10 mL/kg, PO, BID), lapatanib (50 mg/kg, PO, BID, 30 % Captisol®), neratinib (40 mg/kg, QD, PO, acidified 30 % Captisol®) and *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine (75 mg/kg, PO, BID, 30 % Captisol, weigh out compound and add 30 % Captisol® to give 7.5 mg/mL solution, then add 5 N HCl in 200 μL increments until it forms a clear, yellow solution). The mice were monitored daily for general health and behavioral/neurological effects, and body weights were determined twice weekly. At first sign of neurological problem or body weight loss of greater than 20 %, the mice were

euthanized by CO_2 inhalation. Brain and plasma were collected for analyses. Figure 6 shows the percentage of surviving mice.

Example 5

Anti-Tumor Efficacy on N87 Human Gastric Cancer in Murine Xenograft Model

[00122] Nude nu/nu female mice (NCI, Bethesda, MD) were split into five groups (N = 8). Tumor cells (NCI-N87 gastric carcinoma cells, NCI, Bethesda, MD 1 X 10^7) were implanted into the mice via subcutaneous injection (100 μL) directly on the right flank. To ensure good tumor take, the cells should be greater than 90 % viable (thus, the intitial cell suspension of 1 X 10^7 cells/mL were injected for 1 X 10^6 cells injected / 100 μL). The tumors were allowed to grow to 150 ± 50 mm^3. The tumor size was measured, and the mice were weighed. The mice were administered vehicle (30 % Captisol®, 150 g in 500 mL DI water, PO, BID), lapatanib (50 mg/kg, PO, BID, 30 % Captisol®), lapatanib (100 mg/kg, PO, BID, 30 % Captisol®), *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine (50 mg/kg, PO, QD, 30 % Captisol) and *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine (100 mg/kg, PO, QD, 30 % Captisol). The tumor volume was measured. The number of partial responses in the mice was as follows: lapatanib (50 mg/kg) 0, lapatanib (100 mg/kg) 1, ARRY-380 (50 mg/kg) 1, ARRY-380 (100 mg/kg) 4. The results are shown in Figure 7.

Example 6

30% Solid Dispersion using PVP-VA

[00123] A solid dispersion was prepared containing 30 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and PVP-VA using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 100°C at a flow rate of 22 mL/minute, drying gas flow rate of 35 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 19.6 g (87.7% yield) of the solid dispersion. Physicochemical analysis results are in Table 4. Residual solvent analysis showed that the dispersion had less than 0.5% THF and no detectable MeOH.

[00124] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The

dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 63.46 μg/mL and 245.05 μg/mL*hr, respectively. The Cmax and AUC for the free drug species was 52.50 μg/mL and 204.12 μg/mL*hr, respectively.

Example 7

30% Solid Dispersion using Eudragit

[00125] A solid dispersion was prepared containing 30 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and Eudragit L100 using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 100°C at a flow rate of 22 mL/minute, drying gas flow rate of 35 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 18.6 g (82.7% yield) of the solid dispersion. Physicochemical analysis results are in Table 4. Residual solvent analysis showed that the dispersion had about 4.5% THF and no detectable MeOH.

[00126] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 22.70 μg/mL and 71.06 μg/mL*hr, respectively. The Cmax and AUC for the free drug species was 9.26 μg/mL and 35.49 μg/mL*hr, respectively.

Example 8

30% Solid Dispersion using HPMCP

[00127] A solid dispersion was prepared containing 30 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and HPMCP H-55 using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 100°C at a flow rate of 22 mL/minute, drying gas flow rate of 35 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 20.3 g (90.3% yield) of the

solid dispersion. Physicochemical analysis results are in Table 4. Residual solvent analysis showed that the dispersion had less than 0.5% THF and no detectable MeOH.

[00128] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 25.00 µg/mL and 96.66 µg/mL*hr, respectively. The Cmax and AUC for the free drug species was 16.15 µg/mL and 56.81 µg/mL*hr, respectively.

Example 9

30% Solid Dispersion using CAP

[00129] A solid dispersion was prepared containing 30 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and CAP using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 100°C at a flow rate of 22 mL/minute, drying gas flow rate of 35 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 20.0 g (90.4% yield) of the solid dispersion. Physicochemical analysis results are in Table 4. Residual solvent analysis showed that the dispersion had less than 0.5% THF and no detectable MeOH.

[00130] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 11.62 µg/mL and 36.69 µg/mL*hr, respectively. The Cmax and AUC for the free drug species was 5.64 µg/mL and 20.58 µg/mL*hr, respectively.

Example 10

30% Solid Dispersion using HPMCAS

[00131] A solid dispersion was prepared containing 30 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and HPMCAS Grade M using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 80°C at a flow rate of 35

mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 163.19 mg (48.3% yield) of the solid dispersion. Physicochemical analysis results are in Table 4. Residual solvent analysis showed that the dispersion had less than 0.5% THF and no detectable MeOH.

[00132] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 19.04 µg/mL and 68.09 µg/mL*hr, respectively. The Cmax and AUC for the free drug species was 13.50 µg/mL and 51.74 µg/mL*hr, respectively.

Table 4

Example	Polymer	API: Polymer	HPLC (area%)	T_g (°C)	TGA wt loss (%)	% THF (w/w)	Hygroscopicity (% wt change at 80% RH)
REF			99.39		4.9		<1%
6	PVP-VA	3:7	99.45	117	2.3	0.5	14.4
7	Eudragit L100	3:7	98.63	116	5.9	4.5	7.5
8	HPMCP H-55	3:7	97.30	149	1.7	0.3	7.5
9	CAP	3:7	95.45	179	1.9	0.5	7.8
10	HPMCAS	3:7		113	NA	NA	NA

Example 11

60% Solid Dispersion using PVP-VA

[00133] A solid dispersion was prepared containing 60 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and PVP-VA using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 80°C at a flow rate of 35 mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C

under vacuum for about 16 hours. The spray drying yielded 135.0 mg (88.2% yield) of the solid dispersion.

[00134] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 34.80 μg/mL and 133.76 μg/mL*hr, respectively. The Cmax and AUC for the free drug species was 21.88 μg/mL and 84.43 μg/mL*hr, respectively.

Example 12

60% Solid Dispersion using Eudragit

[00135] A solid dispersion was prepared containing 60 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and Eudragit L100 using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 80°C at a flow rate of 35 mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 88.1 mg (52.4% yield) of the solid dispersion.

[00136] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 26.82 μg/mL and 84.49 μg/mL*hr, respectively. The Cmax and AUC for the free drug species was 9.85 μg/mL and 34.89 μg/mL*hr, respectively.

Example 13

60% Solid Dispersion using HPMCP

[00137] A solid dispersion was prepared containing 60 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and HPMCP H-55 using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 80°C at a flow rate of 35 mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66

m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 98.0 mg (58.0% yield) of the solid dispersion.

[00138] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 32.21 μg/mL and 38.28 μg/mL*hr, respectively. The Cmax and AUC for the free drug species was 9.96 μg/mL and 38.28 μg/mL*hr, respectively.

Example 14

60% Solid Dispersion using CAP

[00139] A solid dispersion was prepared containing 60 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and CAP using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 80°C at a flow rate of 35 mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 74.9 mg (44.6% yield) of the solid dispersion.

[00140] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 51.98 μg/mL and 144.91 μg/mL*hr, respectively. The Cmax and AUC for the free drug species was 15.07 μg/mL and 59.69 μg/mL*hr, respectively.

Example 15

60% Solid Dispersion using HPMCAS

[00141] A solid dispersion was prepared containing 60 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and HPMCAS Grade M using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 5% spray solution concentration, an inlet temperature of 80°C at a flow rate of 35 mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of

0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 40°C under vacuum for about 16 hours. The spray drying yielded 113.3 mg (67.2% yield) of the solid dispersion.

[00142] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The solid dispersion was suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the total drug species (colloidal + free) was 26.45 µg/mL and 96.21 µg/mL*hr, respectively. The Cmax and AUC for the free drug species was 10.96 µg/mL and 42.83 µg/mL*hr, respectively.

Example 16

50% Solid Dispersion using PVP-PA

[00143] A solid dispersion was prepared containing 50 weight percent *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and PVP-VA using a Buchi B-290 mini spray drier. The solid dispersion was spray dried from a MeOH:THF (1:3) solvent system, a 3.9% spray solution concentration, an inlet temperature of 100°C at a flow rate of 30 mL/minute, drying gas flow rate of 40 m^3/hour, nozzle pressure of 80 psig, nozzle gas flow of 0.66 m^3/hour, and a 1.5 mm nozzle type. Secondary drying of the dispersion was done at 50°C under vacuum for about 72 hours. The spray drying yielded 28.7 g (72.7% yield) of the solid dispersion.

Example 17

Pharmaceutical Composition 1

[00144] Tablets containing the solid dispersions of any of Examples 6 to 16 may be prepared in a conventional manner comprising:

Function	**Ingredient**	**% of Blend**
API	Solid dispersion as prepared in Example 16	50
Disintegrant	Crospovidone – Polyplasdone®	6
Osmogen	NaCl	5
Osmogen	KCl	5
Glidant	Colloidal Silicon Dioxide	0.5

Function	Ingredient	% of Blend
Lubricant	Magnesium Stearate	0.25
Extragranular		
Binder / Diluent	Microcrystalline cellulose – Avicel®	19.25
Osmogen	NaCl	4.625
Osmogen	KCl	4.625
Disintegrant	Polyplasdone	4
Glidant	Colloidal Silicon Dioxide	0.5
Lubricant	Magnesium Stearate	0.25

[00145] In one preparation, tablets were made using OPADRY II 85F92727 at 3% by weight as a tablet coating. The tablets contained 150 mg of API.

Example 18

Pharmaceutical Composition 2

[00146] Tablets containing the solid dispersions of any of Examples 2 to 12 may be prepared in a conventional manner comprising:

Function	Ingredient	% of Blend
API	Solid dispersion as prepared in Example 16	50
Disintegrant	Crospovidone – Polyplasdone®	6
Disintegrant	$NaHCO_3$	3
Osmogen	NaCl	5
Osmogen	KCl	5
Glidant	Colloidal Silicon Dioxide	0.5
Lubricant	Magnesium Stearate	0.25
Extragranular		
Binder / Diluent	Microcrystalline cellulose – Avicel®	16.25
Osmogen	NaCl	4.625
Osmogen	KCl	4.625

Function	Ingredient	% of Blend
Disintegrant	Polyplasdone	4
Glidant	Colloidal Silicon Dioxide	0.5
Lubricant	Magnesium Stearate	0.25

[00147] In one preparation, tablets were made using OPADRY II 85F92727 at 3% by weight as a tablet coating. The tablets contained 150 mg of API.

Example 19

Pharmaceutical Composition 3

[00148] Tablets containing the solid dispersions of any of Examples 2 to 12 may be prepared in a conventional manner comprising:

Function	Ingredient	% of Blend
API	Solid dispersion as prepared in Example 16	50
Disintegrant	Crospovidone – Polyplasdone®	6
Osmogen	NaCl	10.625
Osmogen	KCl	10.625
Filler	Lactose	21.25
Glidant	Colloidal Silicon Dioxide	0.5
Lubricant	Magnesium Stearate	0.25
Extragranular		
Glidant	Colloidal Silicon Dioxide	0.5
Lubricant	Magnesium Stearate	0.25

[00149] In one preparation, tablets were made using OPADRY II 85F92727 at 3% by weight as a tablet coating. The tablets contained 150 mg of API.

Example 20

Stability Screen

[00150] A stability screen of the spray dried dispersions was completed at 40°C, 75% relative humidity under open conditions, in glass vials, over a period of 8 days. Results are shown in Table 5.

Table 5

Time	HPLC Area %			
	Example 6	Example 7	Example 8	Example 9
Standard	99.39	99.39	99.39	99.39
As received	99.45	98.63	97.30	95.45
4 days	99.21	96.10	93.03	90.89
8 days	99.35	93.16	86.63	87.15

[00151] The main degradant observed was a carbamate impurity, likely due to the acidic nature of some of these polymers. XRPD analysis over the course of the study showed no evidence of crystallization for any solid dispersion of Examples 6-9.

Example 21

*N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine freebase hemi-ethanolate

[00152] Step 1: (*E*)-*N'*-(2-Cyano-4-(3-(1-hydroxy-2-methylpropan-2-yl)thioureido) phenyl)-*N*,*N*-dimethylformimidamide was coupled with 4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylaniline in isopropyl acetate:acetic acid (65:35 v/v) at 45°C to yield 1-(4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)-3-(1-hydroxy-2-methylpropan-2-yl)thiourea (91%).

[00153] Step 2: 1-(4-((4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl) amino)quinazolin-6-yl)-3-(1-hydroxy-2-methylpropan-2-yl)thiourea was agitated in tetrahydrofuran under basic conditions (2.5N NaOH), followed by the addition of *p*-toluenesulfonyl chloride. Water was charged to yield *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine (96%) as a mixture of polymorphs (generally a mixture containing one or more of Form C, Form G hemi-THF, Form G mono-THF, Form M or Form P).

[00154] Step 3: *N*4-(4-([1,2,4]Triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine from Step 2 was triturated in

ethanol at greater than 65°C to provide *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine Form B Ethanol (89%).

[00155] Dissolution testing was performed at a pH of 6.5 in phosphate buffer. The crystals (particles) were suspended in H_2O and added directly to the buffer solution at 37°C. The dissolution profile was collected over a period of about 240 minutes. The Cmax and AUC for the free drug species was 0.44 μg/mL and 5.49 μg/mL*hr, respectively.

Example 22

In vivo Pharmacokinetics in Beagles

[00156] The solid dispersion of Example 6 was tested against a crystalline, micronized suspension formulation (d(v, 0.9) = 3.0μm) of Example 21 under normal fasted conditions, as well as with pretreatment using pentagastrin or famotidine. The solid dispersion of Example 6 was prepared as a suspension in water and administered orally. The micronized suspension of Example 21 was prepared as a suspension with SyrSpend® SF Dry reconstituted with water and administered orally. To reduce variability, beagles were crossed over from pentagastrin to famotidine after a 5 day washout period. Pentagastrin is a pH modifier to modify gastric pH to about 2 to 3, and famotidine is a pH modifier to modify gastric pH to about 5 to 7.5 (Zhou, Rong, *et al*. "pH-Dependent Dissolution *in Vitro* and Absorption *in Vivo* of Weakly Basic Drugs: Development of a Canine Model." Pharm. Res. Vol. 22, No. 2 (Feb. 2005): pp. 188-192). There were four beagles per group. Group A received pentagastrin pretreatment, the micronized suspension of Example 21, followed by a 5 day washout period, then famotidine pretreatment, and finally the micronized suspension of Example 21. Group B received pentagastrin pretreatment, the solid dispersion of Example 6, followed by a 5 day washout period, then famotidine pretreatment, and finally the solid dispersion of Example 6. Group C received the micronized suspension of Example 21, followed by a 5 day washout period, and finally the solid dispersion of Example 6. Results are shown in Table 6.

Table 6

Pretreatment	Dosing Formulation	AUC_{inf} (μg*hr/mL)	C_{max} (μg/mL)
None	Micronized Suspension of Example 12	7.43 ± 1.77	1.88 ± 0.35
	Solid Dispersion of Example 1	10.0 ± 2.7	2.29 ± 0.54
6 μg/kg Pentagastrin	Micronized Suspension of Example 12	17.2 ± 2.7	3.29 ± 0.13
	Solid Dispersion of Example 1	13.0 ± 3.6	3.12 ± 0.62

Pretreatment	Dosing Formulation	AUC_{inf} (μg*hr/mL)	C_{max} (μg/mL)
40 mg/kg Famotidine	Micronized Suspension of Example 12	1.74 ± 0.39	0.514 ± 0.092
	Solid Dispersion of Example 1	6.32 ± 2.88	1.45 ± 0.54

[00157] It will be understood that the enumerated embodiments are not intended to limit the invention to those embodiments. On the contrary, the invention is intended to cover all alternatives, modifications and equivalents, which may be included within the scope of the present invention as defined by the claims. Thus, the foregoing description is considered as illustrative only of the principles of the invention.

[00158] The words "comprise," "comprising," "include," "including," and "includes" when used in this specification and in the following claims are intended to specify the presence of stated features, integers, components, or steps, but they do not preclude the presence or addition of one or more other features, integers, components, steps, or groups thereof.

CLAIMS

1. The use of an amorphous solid dispersion dosage form comprising *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and a dispersion polymer in the manufacture of a medicament for the treatment of local or metastatic brain cancer that is caused by ErbB2 over-expression or amplification, wherein the use is after previous treatment for brain cancer.

2. The use of Claim 1, wherein the dispersion polymer is selected from the group consisting of vinylpyrrolidine vinylacetate copolymer, methylacrylic acid methyl methacrylate copolymer, hydroxypropyl methyl cellulose phthalate, cellulose acetate phthalate, hydroxypropyl methyl cellulose acetate succinate, hydroxypropyl methyl cellulose, and mixtures thereof.

3. The use of Claims 1 or 2, wherein the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine is in the form of a tablet.

4. The use of any one of Claims 1 to 3, wherein the use is in combination with another therapeutic agent.

5. The use of Claim 4, wherein the therapeutic agent is selected from trastuzumab, capecitabine, bevacizumab, paclitaxel and docetaxel.

6. The use of Claim 1, wherein the previous treatment for brain cancer is selected from surgery, radiation therapy and chemotherapy or mixtures thereof.

7. The use of Claim 1, wherein the previous treatment for brain cancer is selected from surgery, conventional external radiation therapy, three-dimensional conformal radiation therapy, intensity modulated radiation therapy, stereotactic radiosurgery, fractionated stereotactic radiation therapy, proton radiation therapy, internal or implant radiation therapy, temozolomide, bevacizumab, carmustine, lomustine, procarbazine, vincristine, tumor treating fields therapy, everolimus, procarbazine, lomustine, cisplatin, carboplatin and methotrexate or mixtures thereof.

8. The use of any one of Claims 1 to 7, wherein about 550 to about 650 mg twice per day of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine is used.

9. The use of an amorphous solid dispersion dosage form comprising *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine and a dispersion polymer in the manufacture of

a medicament for the treatment of local or metastatic brain cancer that is caused by ErbB2 over-expression or amplification, wherein the use is after previous treatment for breast cancer.

10. The use of Claim 9, wherein the dispersion polymer is selected from the group consisting of vinylpyrrolidine vinylacetate copolymer, methylacrylic acid methyl methacrylate copolymer, hydroxypropyl methyl cellulose phthalate, cellulose acetate phthalate, hydroxypropyl methyl cellulose acetate succinate, hydroxypropyl methyl cellulose, and mixtures thereof.

11. The use of Claims 9 or 10, wherein the *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine is in the form of a tablet.

12. The use of any one of Claims 9 to 11, wherein the use is in combination with another therapeutic agent.

13. The use of Claim 12, wherein the therapeutic agent is selected from trastuzumab, capecitabine, bevacizumab, paclitaxel and docetaxel.

14. The use of Claim 9, wherein the previous treatment for breast cancer is selected from surgery, sentinel lymph node biopsy followed by surgery, radiation therapy, chemotherapy, hormone therapy and targeted therapy.

15. The use of Claim 9, wherein the previous treatment for breast cancer is selected from lumpectomy, partial mastectomy, segmental mastectomy, total mastectomy, modified radical mastectomy, external radiation, internal radiation, methotrexate, paclitaxel albumin-stabilized nanoparticle formulation, ado-trastuzumab emtansine, doxorubicin, fluorouracil, everolimus, anastrozole, exemestane, capecitabine, cyclophosphamide, docetaxel, epirubicin, exemestane, toremifene, fulvestrant, letrozole, gemcitabine, trastuzumab, ixabepilone, lapatinib, tamoxifen, pertuzumab and toremifene, or mixtures thereof.

16. The use of any one of Claims 9 to 15, wherein about 550 to about 650 mg twice per day of *N*4-(4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)-*N*6-(4,4-dimethyl-4,5-dihydrooxazol-2-yl)quinazoline-4,6-diamine is used.

17. The use of (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol in the manufacture of a medicament for the treatment of local or metastatic brain cancer that is caused by ErbB2 over-expression or amplification, wherein the use is after previous treatment for brain cancer.

18. The use of Claim 17, wherein the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is in the form of an oral dosage form.

19. The use of Claims 17 or 18, wherein the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is a solid dispersion dosage form.

20. The use of Claim 19, wherein the solid dispersion dosage form contains a dispersion polymer selected from the group consisting of vinylpyrrolidine vinylacetate copolymer, methylacrylic acid methyl methacrylate copolymer, hydroxypropyl methyl cellulose phthalate, cellulose acetate phthalate, hydroxypropyl methyl cellulose acetate succinate, hydroxypropyl methyl cellulose, and mixtures thereof.

21. The use of any one of Claims 17 to 20, wherein the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is in the form of a tablet.

22. The use of any one of Claims 17 to 21, wherein the use is in combination with another therapeutic agent.

23. The use of Claim 22, wherein the therapeutic agent is selected from trastuzumab, capecitabine, bevacizumab, paclitaxel and docetaxel.

24. The use of Claim 17, wherein the previous treatment for brain cancer is selected from surgery, radiation therapy and chemotherapy or mixtures thereof.

25. The use of Claims 17, wherein the previous treatment for brain cancer is selected from surgery, conventional external radiation therapy, three-dimensional conformal radiation therapy, intensity modulated radiation therapy, stereotactic radiosurgery, fractionated stereotactic radiation therapy, proton radiation therapy, internal or implant radiation therapy, temozolomide, bevacizumab, carmustine, lomustine, procarbazine, vincristine, tumor treating fields therapy, everolimus, procarbazine, lomustine, cisplatin, carboplatin and methotrexate or mixtures thereof.

26. The use of any one of Claims 17 to 25, wherein about 25 to about 1800 mg per day of (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is used.

27. The use of (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol in the manufacture of a medicament for the treatment of local or metastatic brain cancer that is

caused by ErbB2 over-expression or amplification, wherein the use is after previous treatment for breast cancer.

28. The use of Claim 27, wherein the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is in the form of an oral dosage form.

29. The use of Claims 27 or 28, wherein the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is a solid dispersion dosage form.

30. The use of Claim 29, wherein the solid dispersion dosage form contains a dispersion polymer selected from the group consisting of vinylpyrrolidine vinylacetate copolymer, methylacrylic acid methyl methacrylate copolymer, hydroxypropyl methyl cellulose phthalate, cellulose acetate phthalate, hydroxypropyl methyl cellulose acetate succinate, hydroxypropyl methyl cellulose, and mixtures thereof.

31. The use of any one of Claims 27 to 30, wherein the (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is in the form of a tablet.

32. The use of any one of Claims 27 to 31, wherein the use is in combination with another therapeutic agent.

33. The use of Claim 32, wherein the therapeutic agent is selected from trastuzumab, capecitabine, bevacizumab, paclitaxel and docetaxel.

34. The use of Claim 27, wherein the previous treatment for breast cancer is selected from surgery, sentinel lymph node biopsy followed by surgery, radiation therapy, chemotherapy, hormone therapy and targeted therapy.

35. The use of Claim 27, wherein the previous treatment for breast cancer is selected from lumpectomy, partial mastectomy, segmental mastectomy, total mastectomy, modified radical mastectomy, external radiation, internal radiation, methotrexate, paclitaxel albumin-stabilized nanoparticle formulation, ado-trastuzumab emtansine, doxorubicin, fluorouracil, everolimus, anastrozole, exemestane, capecitabine, cyclophosphamide, docetaxel, epirubicin, exemestane, toremifene, fulvestrant, letrozole, gemcitabine, trastuzumab, ixabepilone, lapatinib, tamoxifen, pertuzumab and toremifene, or mixtures thereof.

36. The use of any one of Claims 27 to 35, wherein about 25 to about 1800 mg per day of (2-((4-((4-([1,2,4]triazolo[1,5-*a*]pyridin-7-yloxy)-3-methylphenyl)amino)quinazolin-6-yl)amino)-4-methyl-4,5-dihydrooxazol-4-yl)methanol is used.